Robotics Master

Competency

Student understands and writes code using robots.

Key Method

Student uses a range of coding languages and robots to create projects.

Method Components

What is coding?

Simply stated, coding is the language that computers speak. Much like human languages, many different coding languages are used around the world, all of which have different strengths and uses.

To use computers as a tool to shape the world around us, we need to learn these languages. Luckily, coding languages are based on a system of rules. When we write code, we provide a set of instructions for a computer to follow in a way that it understands. Once we understand the rules of coding as a whole, we can start to apply those rules to all the different coding languages.

Why should you learn to code?

One of the reasons most often shared for why young people should learn to code is “to prepare them for the jobs of the future.” This is an important goal; jobs in STEM fields are growing at a rate of close to 8%, compared to just 3.7% for non-STEM jobs. Over 70% of jobs in STEM are computing jobs or use computer science in a major way (US Bureau of Labor Statistics, 2021). Learning to code can be a useful skill in the workforce.

However, you may not end up in a STEM field. Either way, you should still learn how to code!

Coding is not only enjoyable; it also helps you to understand technology. Learning to code means that, rather than being a passive user of technology, you better understand how technology is shaping our lives and societies and how you can use technology to make a positive impact in the world.

Why use robots to learn how to code?

Coding and robotics are often used to mean the same thing, but while they are related they are actually separate learning experiences. Coding can be learned separately from robotics (and you are encouraged to do so). However, learning how to code with robots can be a lot of fun and a great way to deepen your understanding of how the outcome of your code works in the "real world." For example, how might the unevenness of a flooring surface influence your code? These kinds of hands-on problems help to give you a perspective on coding that you might not get from other experiences.

Building vs Programming Robots

When first hearing about robotics, you may feel overwhelmed by the thought of having to build your own robot. While learning about robot design and engineering is absolutely valuable learning (and some robotics tools such as the LEGO Ev3, LEGO Spike, and mBot do incorporate some level of robot construction), this micro-credential will only focus on programming/coding through the application of robotics; robot design and engineering will not be discussed.

5 Skills of Great Programmers

Writing code is about more than, well, just writing code! The 5 skills of great coders are:

1. **Understanding technology concepts**

Yes, an important part of coding is knowing how to code! Great programmers have a solid understanding of the key concepts of code, including sequence, loops, conditionals, and more. They recognize that these concepts are the same across most programming languages, although the exact way they are written and used may be different.

2. **Critical thinking and problem solving**

Great programmers know that mistakes = learning! They recognize that *something* is likely to go wrong or present a challenge every time they work on a project. They are able to analyze problems, break them down into smaller steps, and work through them while still keeping their cool. They use their previous knowledge and experience to find appropriate solutions and approaches to achieve their goals.

3. **Communication and collaboration**

Great programmers communicate effectively with others about their learning and work in a variety of contexts. They are able to work independently and with others to create unique projects, share experiences, and build new skills.

4. **Knowledge constructor**

No single person, course, or video can teach you everything you need to know about coding. Great programmers know that they need to combine their knowledge and skills in new settings to find solutions to new problems and create new projects. They are also able to use a variety of resources and tools to build new knowledge independently.

5. **Digital citizenship**

With great coding power comes great responsibility! Truly great programmers recognize the power of coding and technology to shape the world around them and use their skills responsibly. They respect the work of others, are kind online, and always keep an eye on cybersecurity to help keep themselves safe.

Supporting Rationale and Research

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Resources

Terms and Concepts

- Algorithm: a single set of step-by-step instructions that tells a computer how to perform a task.
- Program: a set of step-by-step instructions that tells a computer how to perform a task. A program can be simple (including just one algorithm) or complex (including multiple algorithms).
- Sequence: the order in which your computer will run your code. A computer will run your code in the exact order it is written in, so the order in which you write your code matters.

- Event: an event is something a computer is always looking for; e.g., the user pressing a button. Events are often used to trigger other actions within a program; e.g., when the user presses the A key (event), the symbol A will appear on the screen (action).
- Loop: a repeating section of code. A loop will repeat until a certain condition is met; e.g., repeat # of times, repeat until something else happens, repeat infinitely, etc.
- Conditional: an "if...then…" statement. The computer will choose between a set of options based on whether a condition is true or false.
- Variable: can store data. It is associated with a symbol or name that can be referred to throughout the program.
- Function: a "sub-program" within code that performs a specific action. A function is often used to store a series of actions that will be required multiple times throughout the program but not necessarily one after the other. By assigning a name to the function, it can be "called" at any point in the program to run the series of actions.

Submission Guidelines & Evaluation Criteria

To earn the micro-credential, you must receive a passing evaluation for Parts 1 and 3, and a "Yes" for Part 2.

Part 1. Overview Questions

1. How old are you?
2. How would you rate your confidence when it comes to STEM? (out of 5 stars)
3. How would you rate your ability when it comes to STEM?
    a. I'm a total beginner; I've never done this before.
    b. I'm pretty new to this; I have only a little bit of experience.
    c. I've got some experience and am looking to take my learning to the next level.
    d. I've got lots of experience, and I'm ready for more advanced stuff!
4. How would you rate your interest in exploring a STEM career when you get older? (out of 5 stars)
5. What are you most hoping to get out of your STEAM Hub course? Why?

Passing: The participant has responded to the survey answering all of the question prompts.

Part 2. Work Examples/Artifacts/Evidence

To earn this micro-credential, submit the following artifacts:

Artifact 1: Badges

1. Badge for THREE of the following STEAM Hub courses:

a. Robotics with Dash
b. Robotics with Sphero
c. Robotics with LEGO Ev3

Artifact 2: STEAM Hub Course Final Project
For the STEAM Hub course you selected above, please submit a copy of your final project. It must include:

1. the full project file (please do not submit screenshots)
2. any relevant share settings appropriately set to allow anyone to view the project

Part 2. Scoring Guide

Artifact	"Yes"	"Almost"	"Not Yet"
Artifact 1	The course badges were provided.	N/A	The course badges were not provided.
Artifact 2	The project provided meets the expectations as outlined in the project rubric within the STEAM Hub course at a level of 80% or higher.	The project provided meets the expectations as outlined in the project rubric within the STEAM Hub course at a level of less than 80%.	The project was not provided.

Part 3. Reflection

Please write your responses below (500 words maximum).

1. What was the most challenging part of creating your project? How did you deal with these challenges?
2. What part of your project are you most proud of? Why?
3. Discuss what you have learned about coding and robotics. Could you see yourself pursuing a career in this industry? Why or why not?

Passing: Response provides reasonable and accurate information that outlines their experience with learning to code. Student demonstrates a genuine attempt to reflect on their learning process and how their learning will influence their future.